OS Homework 3

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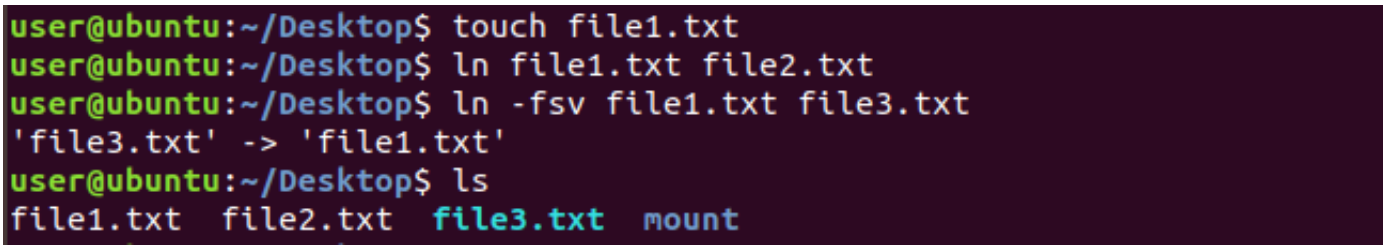
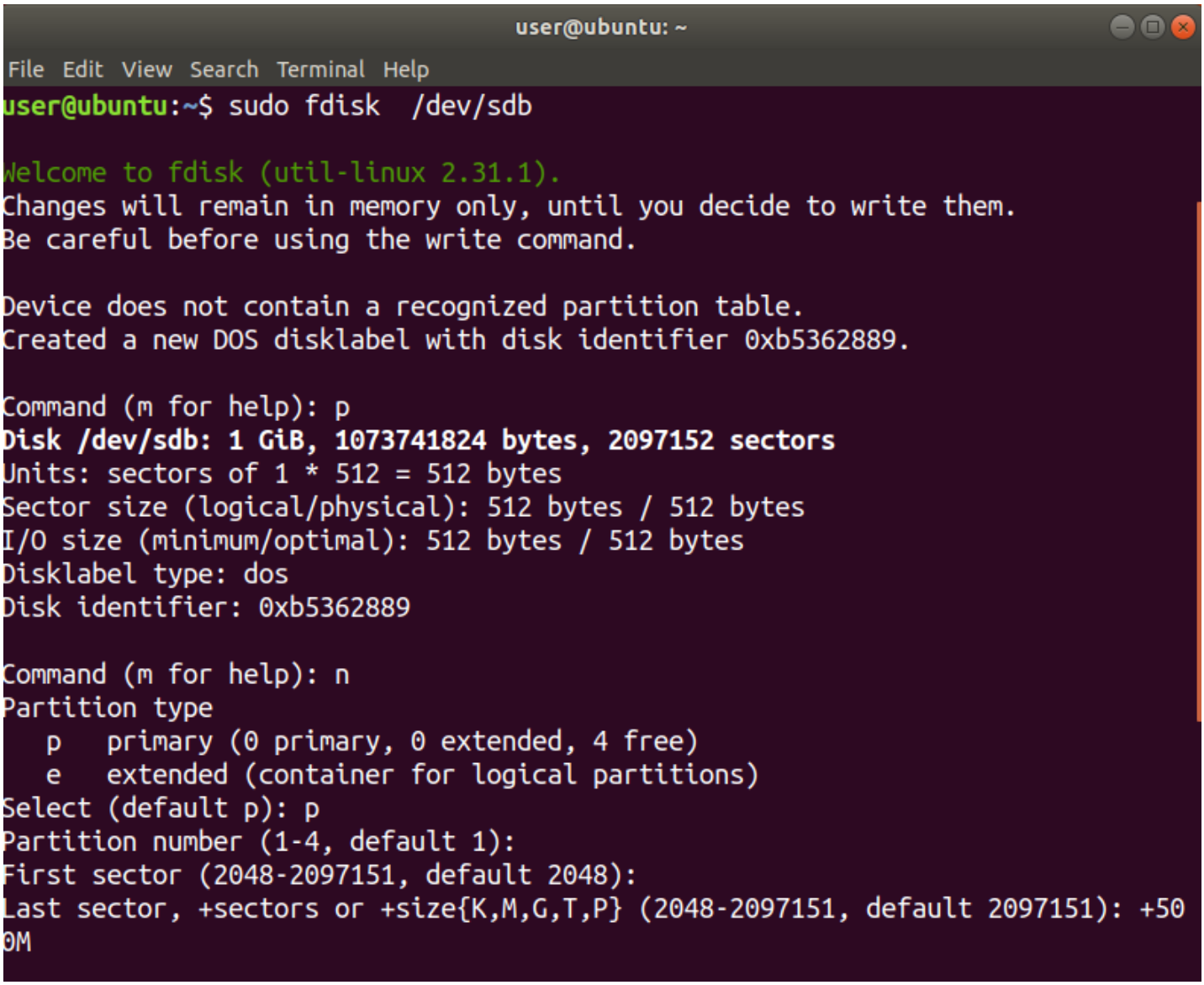
Task 1

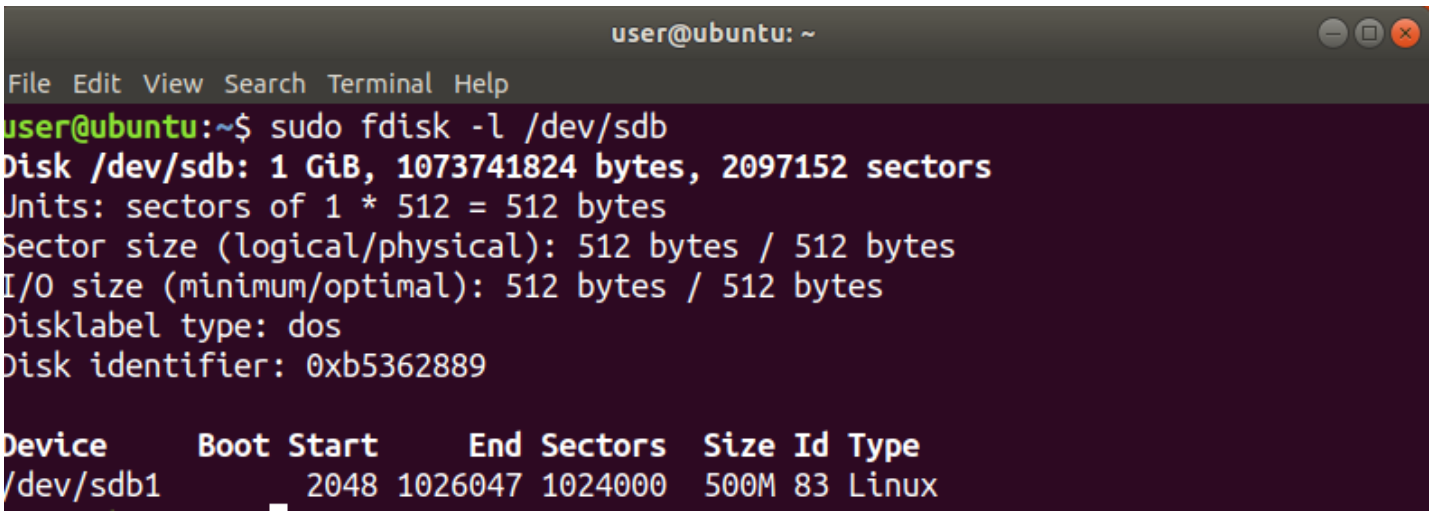
```
touch file1.txt
ln file1.txt file2.txt
ln -fsv file1.txt file3.txt
```



Task 2

```
sudo fdisk /dev/sdb
sudo fdisk -l /dev/sdb
sudo mkfs.ext4 -b 4096 -N 800 /dev/sdb1
sudo blkid
cd /etc
vim fstab
mount -a
df -h
```


user@ubuntu: ~
File Edit View Search Terminal Help
user@ubuntu:~$ sudo fdisk /dev/sdb
Welcome to fdisk (util-linux 2.31.1).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.
Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0xb5362889.
Command (m for help): p
Disk /dev/sdb: 1 GiB, 1073741824 bytes, 2097152 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0xb5362889
Command (m for help): n
Partition type
p primary (0 primary, 0 extended, 4 free)
e extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-2097151, default 2048):
Last sector, +sectors or +size{K,M,G,T,P} (2048-2097151, default 2097151): +50
0M


user@ubuntu: ~
File Edit View Search Terminal Help
user@ubuntu:~$ sudo fdisk -l /dev/sdb
Disk /dev/sdb: 1 GiB, 1073741824 bytes, 2097152 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0xb5362889
Device Boot Start End Sectors Size Id Type
/dev/sdb1 2048 1026047 1024000 500M 83 Linux

```
user@ubuntu:~$ sudo mkfs.ext4 -b 4096 -N 800 /dev/sdb1
mke2fs 1.44.1 (24-Mar-2018)
Creating filesystem with 128000 4k blocks and 896 inodes
Filesystem UUID: 44754963-9015-4db6-bb62-67c9b0fae947
Superblock backups stored on blocks:
        32768, 98304

Allocating group tables: done
Writing inode tables: done
Creating journal (4096 blocks): done
Writing superblocks and filesystem accounting information: done
```

```
user@ubuntu:~$ sudo blkid
/dev/loop0: TYPE="squashfs"
/dev/loop1: TYPE="squashfs"
/dev/loop2: TYPE="squashfs"
/dev/loop3: TYPE="squashfs"
/dev/loop4: TYPE="squashfs"
/dev/loop5: TYPE="squashfs"
/dev/loop6: TYPE="squashfs"
/dev/loop7: TYPE="squashfs"
/dev/sda1: UUID="3b68828e-32ad-4379-a4dc-a635ed5acbe6" TYPE="ext4" PARTUUID="3bcfbe07-01"
/dev/loop8: TYPE="squashfs"
/dev/loop9: TYPE="squashfs"
/dev/loop10: TYPE="squashfs"
/dev/loop11: TYPE="squashfs"
/dev/loop12: TYPE="squashfs"
/dev/loop13: TYPE="squashfs"
/dev/sdb1: UUID="44754963-9015-4db6-bb62-67c9b0fae947" TYPE="ext4" PARTUUID="b5362889-01"
```

```
user@ubuntu:/etc$ cat /etc/fstab
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point>   <type>  <options>       <dump>  <pass>
# / was on /dev/sda1 during installation
UUID=3b68828e-32ad-4379-a4dc-a635ed5acbe6 /               ext4    errors=remount-ro 0       1
/swapfile                                 none            swap    sw              0       0
/dev/fd0        /media/floppy0  auto    rw,user,noauto,exec,utf8 0
UUID=44754963-9015-4db6-bb62-67c9b0fae947 / ext4 defaults 0 0
```

```
user@ubuntu:~/Desktop$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            1.9G     0  1.9G   0% /dev
tmpfs           394M  1.5M  393M   1% /run
/dev/sdb1       9.8G  5.7G  3.6G  62% /
tmpfs           2.0G     0  2.0G   0% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           2.0G     0  2.0G   0% /sys/fs/cgroup
/dev/loop1       56M   56M     0 100% /snap/core18/1885
/dev/loop2      256M  256M     0 100% /snap/gnome-3-34-1804/36
/dev/loop0       65M   65M     0 100% /snap/gtk-common-themes/1514
/dev/loop3      2.3M  2.3M     0 100% /snap/gnome-system-monitor/148
/dev/loop4      2.5M  2.5M     0 100% /snap/gnome-calculator/748
/dev/loop5      218M  218M     0 100% /snap/gnome-3-34-1804/60
/dev/loop6      1.0M  1.0M     0 100% /snap/gnome-logs/100
/dev/loop7       56M   56M     0 100% /snap/core18/1944
/dev/loop8       30M   30M     0 100% /snap/snapd/8542
/dev/loop10      63M   63M     0 100% /snap/gtk-common-themes/1506
/dev/loop9      384K  384K     0 100% /snap/gnome-characters/570
/dev/loop11      32M   32M     0 100% /snap/snapd/10707
/dev/loop12     2.5M  2.5M     0 100% /snap/gnome-calculator/826
/dev/loop13     384K  384K     0 100% /snap/gnome-characters/550
tmpfs           394M   28K  394M   1% /run/user/121
tmpfs           394M   32K  394M   1% /run/user/1000
/dev/sda1       484M  768K  449M   1% /home/user/Desktop/mount
```

Task 3

1

```
cd /Desktop/mount
sudo mkdir s{1..900}
sudo dumpe2f2 /dev/sda1
```

886 directories。因為受到 inodes 數量限制。

```
mkdir: cannot create directory ‘s886’: No space left on device
mkdir: cannot create directory ‘s887’: No space left on device
mkdir: cannot create directory ‘s888’: No space left on device
mkdir: cannot create directory ‘s889’: No space left on device
mkdir: cannot create directory ‘s890’: No space left on device
mkdir: cannot create directory ‘s891’: No space left on device
mkdir: cannot create directory ‘s892’: No space left on device
mkdir: cannot create directory ‘s893’: No space left on device
mkdir: cannot create directory ‘s894’: No space left on device
mkdir: cannot create directory ‘s895’: No space left on device
mkdir: cannot create directory ‘s896’: No space left on device
mkdir: cannot create directory ‘s897’: No space left on device
mkdir: cannot create directory ‘s898’: No space left on device
mkdir: cannot create directory ‘s899’: No space left on device
mkdir: cannot create directory ‘s900’: No space left on device
```

查詢後 Inode 數量為 896。

而 inode table 本身佔用了一些空間，查詢後發現有 4 個 Block Group，directories 的數量有 887 個。

```
user@ubuntu:~/Desktop/mount$ sudo dumpe2fs /dev/sda1
dumpe2fs 1.44.1 (24-Mar-2018)
Filesystem volume name:   <none>
Last mounted on:          <not available>
Filesystem UUID:          44754963-9015-4db6-bb62-67c9b0fae947
Filesystem magic number:  0xEF53
Filesystem revision #:    1 (dynamic)
Filesystem features:      has_journal ext_attr resize_inode dir_index fi
needs_recovery extent 64bit flex_bg sparse_super large_file huge_file di
 extra_isize metadata_csum
Filesystem flags:         signed_directory_hash
Default mount options:    user_xattr acl
Filesystem state:         clean
Errors behavior:          Continue
Filesystem OS type:       Linux
Inode count:              896
Block count:              128000
Reserved block count:     6400
Free blocks:              123670
Free inodes:              885
First block:              0
Block size:               4096
Fragment size:            4096
```

```
Group 0: (Blocks 0-32767) csum 0xd895 [ITABLE_ZEROED]
  Primary superblock at 0, Group descriptors at 1-1
  Reserved GDT blocks at 2-63
  Block bitmap at 64 (+64), csum 0xf5eb9121
  Inode bitmap at 68 (+68), csum 0xa1ced196
  Inode table at 72-78 (+72)
  31773 free blocks, 0 free inodes, 215 directories
  Free blocks: 995-32767
  Free inodes:
Group 1: (Blocks 32768-65535) csum 0x0385 [ITABLE_ZEROED]
  Backup superblock at 32768, Group descriptors at 32769-32769
  Reserved GDT blocks at 32770-32831
  Block bitmap at 65 (bg #0 + 65), csum 0x36b5165c
  Inode bitmap at 69 (bg #0 + 69), csum 0xa1ced196
  Inode table at 79-85 (bg #0 + 79)
  32704 free blocks, 0 free inodes, 224 directories
  Free blocks: 32832-65535
  Free inodes:
Group 2: (Blocks 65536-98303) csum 0xb62f [ITABLE_ZEROED]
  Block bitmap at 66 (bg #0 + 66), csum 0x6f4a5778
  Inode bitmap at 70 (bg #0 + 70), csum 0xa1ced196
  Inode table at 86-92 (bg #0 + 86)
  28672 free blocks, 0 free inodes, 224 directories
  Free blocks: 69632-98303
  Free inodes:
Group 3: (Blocks 98304-127999) csum 0x8025 [ITABLE_ZEROED]
  Backup superblock at 98304, Group descriptors at 98305-98305
  Reserved GDT blocks at 98306-98367
  Block bitmap at 67 (bg #0 + 67), csum 0x36d10ee6
  Inode bitmap at 71 (bg #0 + 71), csum 0xa1ced196
  Inode table at 93-99 (bg #0 + 93)
  29632 free blocks, 0 free inodes, 224 directories
  Free blocks: 98368-127999
  Free inodes:
```

2

```
sudo rmdir *
sudo truncate -s 1 f{1..4100}.txt
```

886 files。因為 inodes 的數量限制了檔案的數量，所以 block size 也只用了 886 bytes。

```
user@ubuntu:~/Desktop/mount$ sudo truncate -s 1 f{1..4100}.txt
truncate: cannot open 'f887.txt' for writing: No space left on device
truncate: cannot open 'f888.txt' for writing: No space left on device
truncate: cannot open 'f889.txt' for writing: No space left on device
truncate: cannot open 'f890.txt' for writing: No space left on device
truncate: cannot open 'f891.txt' for writing: No space left on device
truncate: cannot open 'f892.txt' for writing: No space left on device
truncate: cannot open 'f893.txt' for writing: No space left on device
truncate: cannot open 'f894.txt' for writing: No space left on device
truncate: cannot open 'f895.txt' for writing: No space left on device
truncate: cannot open 'f896.txt' for writing: No space left on device
truncate: cannot open 'f897.txt' for writing: No space left on device
```

3

```
sudo rm *
sudo truncate -s 600M f.txt
sudo rm *
ulimit
```

發現可超出 file system 的 size，顯示 unlimited。

```
user@ubuntu:~/Desktop/mount$ sudo truncate -s 600M f.txt
user@ubuntu:~/Desktop/mount$ ls
f.txt
user@ubuntu:~/Desktop/mount$ ulimit
unlimited
```